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PROTECTIVE APPARATUS FOR ELECTRO-SENSITIVE PAPER RECORDERS

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2 Sheets-Sheet 1

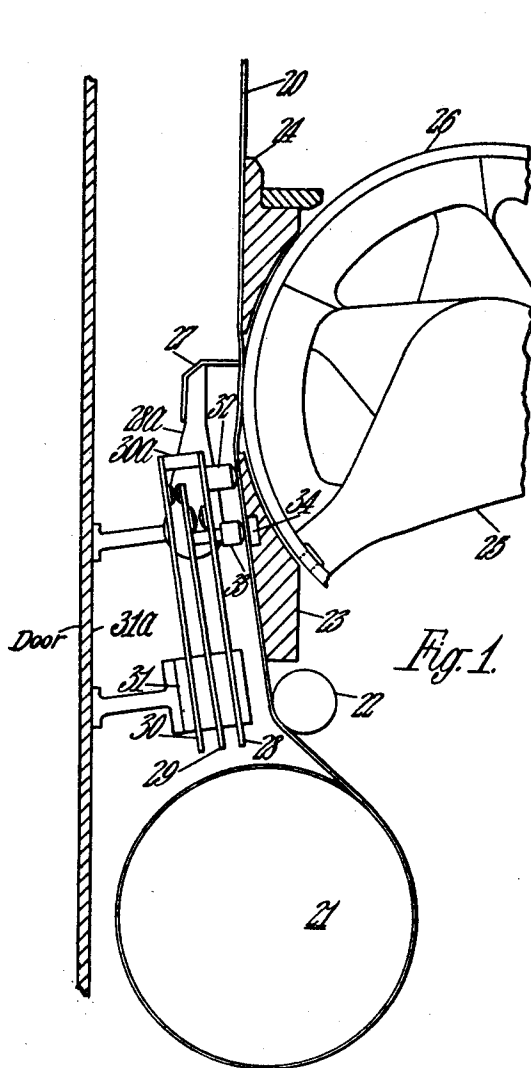


Fig. 1

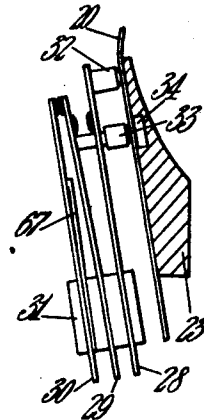


Fig. 2

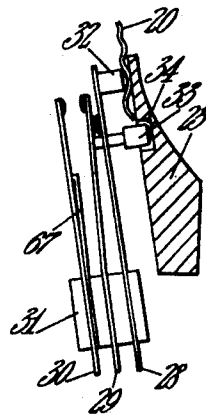


Fig. 3

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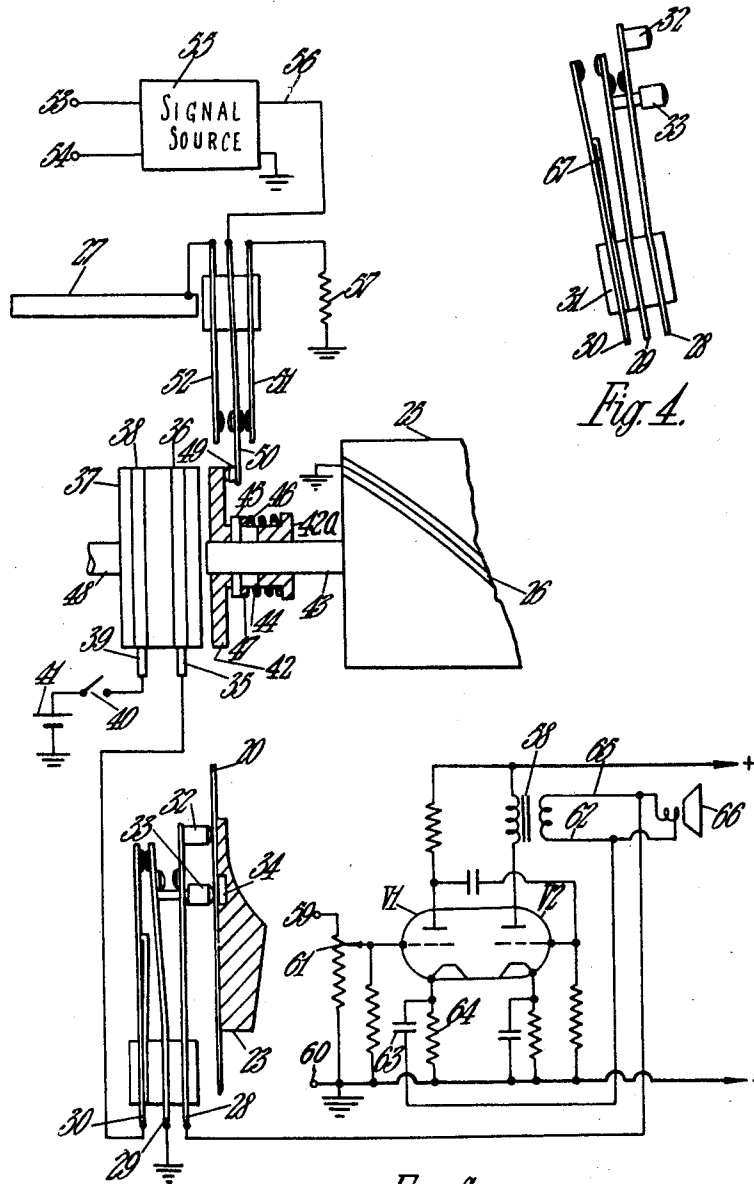


Fig. 4.

Fig. 5.

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PROTECTIVE APPARATUS FOR ELECTRO-SENSITIVE PAPER RECORDERS

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6 Claims. (Cl. 340—259)

This invention relates to protective apparatus suitable for electrosensitive paper recorders. It refers particularly to the device described in U.S. patent application Serial No. 397,609, now abandoned, and provides an addition to, or extension of, the invention described therein.

The above mentioned patent specification describes a protective device having particular application to recording apparatus employing electrosensitive paper and is especially suitable for apparatus making use of an electrolytic recording process wherein the electrosensitive paper is used in the moist state. Its object is to ensure that if the supply of electrosensitive paper, which normally comes from a supply roll, is interrupted, through breakage or tearing or exhaustion of the supply roll, then a contact is operated which automatically stops certain parts of the recording mechanism, or cuts off the recording electrode voltage, or both.

According to the above-mentioned patent specification the electrosensitive paper is passed between a pressure pad or finger and a part of the structure of the recorder which supports the electrosensitive paper. The supporting structure contains a small cavity opposite the pressure pad and the latter presses lightly against the paper, which is supported by the rim of the cavity all round and close to the point of pressure so that stretch or distortion of the paper is minimized. If the paper breaks, or the supply is exhausted, the pressure pad is enabled to move into the cavity and thereby to operate contacts which carry out the protective function.

In order to draw attention to such a failure, it is convenient to arrange that the protective device operates some kind of audible or visible alarm in addition to carrying out its protective function. In the case of facsimile picture or chart recorders using moist electrosensitive paper, the transmission line can also be used during intervals between picture transmissions for telephonic communication and the receiver includes a small speech amplifier and loudspeaker which is not used during picture transmissions. A convenient method of providing an audible alarm signal therefore consists in arranging that the protective device connects the speech amplifier output directly to its input. This causes the speech amplifier to burst into violent oscillation and the loudspeaker emits a noise which compels attention.

Facsimile receivers of this type are normally fitted with a door through which the loading and adjustment of the electrosensitive paper are carried out and it is convenient to arrange for the pressure pad of the protective device to be fitted to the door and the co-operating cavity to be formed in a block which is in the body of the machine, the paper being placed between them and emerging after recording through a slot between the door and the body of the machine. Where the protective apparatus is employed to produce an audible signal in addition to its protective function, as described above, a disadvantage ensues in that the alarm is sounded when the door is opened for normal re-loading or adjustment of

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the paper and it continues to sound until the door is closed, when the protective device is automatically reset.

The object of the present invention is to improve the device above described so that the safety device will operate upon interruption of the paper supply but will not operate when the door of the recorder is opened for replacement of the roll or adjustment of the paper.

A further object is to modify the protective apparatus so that it is responsive to three conditions. In the first condition the door is closed and the paper supply is present, so that the protective device does not operate. The second condition occurs when the paper supply is interrupted and the protective device functions to stop the recording mechanism, to operate the alarm, and (optionally) to reduce the recording electrode voltage to zero. The third condition occurs when the door is opened for normal re-loading or adjustment of the paper, when the device stops the recording mechanism and (optionally) reduces the recording electrode voltage to zero but does not operate the alarm. The object of stopping the recording mechanism in the third condition is that opening the door exposes this mechanism, in which the moving part usually consists of a rotating helix which could cause injury to the operator's hand if caught between it and a part of the fixed structure of the recorder.

The present invention consists of a protective apparatus as described in U.S. patent application Serial No. 397,609 and comprises a second pressure pad or finger adjacent to the first and also adapted to apply pressure to one side of the paper, no cavity being provided opposite the second pressure pad or finger, the two pads or fingers being arranged so that if one is free and the other is under pressure, the apparatus will operate a switch controlling a protective device and/or alarm, while if both are under pressure or both are free, the apparatus will not operate the switch.

In a modification the apparatus is arranged to distinguish between the three states, when both pressure pads are under pressure, when both are free, or when only one is under pressure, and to operate in a different manner in each case.

Embodiments of the invention will now be described in conjunction with the accompanying drawings, but it is to be understood that these are by way of example and that alternative embodiments within the scope of the invention will occur to those skilled in the art. In the drawings:

Figure 1 shows the essential parts of a recorder using electrosensitive paper.

Figures 2, 3 and 4 show three positions for the contacts of the protective device when modified.

Figure 5 shows, diagrammatically, parts of a recorder embodying the protective device.

Referring to Figure 1, a strip of electrosensitive paper 20 is drawn from supply roll 21 over roller 22 and guide blocks 23 and 24 by a driving roller (not shown). A helix assembly arranged for rotation and located between blocks 23 and 24 consists of a structure 25 carrying a helical electrode 26.

A transverse electrode or writing bar 27 is carried by a plurality of arms 28, which are mounted on a shaft (not shown) and are urged by spring means (not shown) towards helix 26. Writing bar 27 presses electrosensitive paper 20 against helix 26 so that a point of electrical contact between writing bar 27 and helix 26 passes across the paper at each revolution of the helix. Electrosensitive paper 20 is drawn between the electrodes at such a rate that the advance of the paper is approximately equal to the thickness of writing bar 27 at each revolution of helix 26; in this way the whole surface of the paper is scanned.

In order to obtain the highest definition, writing bar

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27 and the edge of helix 26 must be as thin as possible and if the paper supply should fail for any reason then physical contact is made between writing bar 27 and helix 26 and damage to one or both parts may occur.

As shown in Figure 1 the protective device comprises contact springs 28, 29 and 30, which are carried in block 31. Block 31 may conveniently be mounted on the door 31a which is provided to give access to roll 21, helix 26 and writing bar 27; writing bar 27 with supporting arms 28a may also be conveniently carried on the door. The distance piece 30a keeps contact springs 28 and 30 a fixed distance apart. A pressure pad 32 fixed to contact spring 28 presses lightly against paper 20 at a point where it is backed by the solid metal of block 23. A similar pressure pad 33 has an extension which passes through contact spring 28 and is fixed to contact spring 29. Pressure pad 33 presses on paper 20 opposite a small cavity in block 23.

Contact springs 28, 29 and 30 are so set initially that contact is made between 29 and 30 and is open between 28 and 29, and this is the position of the contacts when the door is open. When the door is closed, pressure is applied to pressure pads 32 and 33 so that all three contact springs are moved back by an equal amount and the contact arrangement is unaltered. If the supply of paper should fail then pressure pad 33 is enabled to move into cavity 34 so that the contact between 29 and 30 is broken and the contact between 28 and 29 is made.

Figures 2, 3 and 4 show an arrangement of the protective device modified by the omission of distance piece 30a and the addition of a support 67 for contact spring 30. In this case the protective device may be made responsive to three different conditions. The first is shown in Figure 2 and represents the normal working condition with the door closed. In this condition the contact between 29 and 30 is made and that between 28 and 29 is open, as in Figure 1. The protective device is thus inoperative.

Figure 3 shows the second condition in which the supply of paper has been interrupted so that pressure pad 33 has moved into cavity 34. This allows contact spring 29 to move forward to break contact with 30 and make contact with 28. Contact spring 30 is prevented from following contact spring 29 by support 67.

Figure 4 shows the third condition in which the door is open so that pressure is removed from both pressure pads 32 and 33. In this condition contact spring 29 moves to break contact with 30 but 28 is also allowed to move forward so that contact is not made with 29.

Figure 5 shows by way of example control circuits which may be associated with the protective device to carry out the protective functions but it is to be understood that these are shown by way of example only and that alternative methods will occur to those skilled in the art.

The three contacts 28, 29 and 30 are shown as in Figure 2 so that the device may be made responsive to the three conditions described above. It is, however, to be understood that the distance piece 30a of Figure 1 could be included and the support 67 omitted, in which case the arrangement would function in the same way as that shown in Figure 1. Spring contacts 28, 29 and 30, pressure block 23, pressure pads 32 and 33, and electrosensitive paper 20, are the same as those having like reference numerals in Figure 1. Contact spring 29 is connected to earth. Contact spring 30 is connected via brush 35 and slip ring 36 to the winding in magnetic clutch 37, the circuit being completed through slip ring 38, brush 39, switch 40 and battery 41, one pole of which is connected to earth. When the contacts on 29 and 30 are closed then magnetic clutch 37 may be energized by closing switch 40 which may, if desired, be part of an automatic control device operated by a facsimile transmitter. When energized, magnetic clutch 37 attracts armature 42, which is slidably mounted on shaft 43

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which carries assembly 25 supporting helix 26. Helix assembly 25 may be in the form of a drum, but any other suitable structure may be employed.

Armature 42 has an extension 42a having a slot 44 which is engaged by pin 45 in shaft 43. This allows armature 42 to move axially into engagement with magnetic clutch 37 whilst still providing a positive rotational drive. A spring 46 abuts a washer 47 which bears against pin 45 so that armature 42 is urged by spring 46 away from magnetic clutch 37. Assuming that the contacts on 29 and 30 are closed then closure of switch 40 energizes magnetic clutch 37 which attracts armature 42 against the force of spring 46 and the frictional contact between armature 42 and clutch 37 provides the drive to helix assembly 25. Magnetic clutch 37 is driven by a motor and appropriate gearing (not shown) through shaft 48.

Armature 42 bears against a pad 49 on a contact spring 50 having two contacts which respectively engage further contacts on contact springs 51 and 52. When magnetic clutch 37 is de-energized armature 42 is in the position shown in which contact spring 50 is flexed so that contact is made with contact spring 51. When magnetic clutch 37 is energized armature 42 moves towards it and contact spring 50 moves so that contact with spring 51 is broken and contact is made with spring 52.

The signal for the recorder is fed into input terminals 53 and 54 of signal source 55, which may consist of an amplifier and a demodulator, or other apparatus which is suitable for the particular use to which the recorder is to be put. One output lead 56 is connected to contact spring 50 and the other output lead is earthed.

In the position shown, the output of 55 is connected via contact springs 50 and 51 to a resistance 57 which has its other end connected to earth and which provides a dummy load in the output circuit of the signal source. When magnetic clutch 37 is energized and armature 42 moves into contact with it then dummy load 57 is disconnected and output lead 56 is connected through contact springs 51 and 52 to writing bar 27. Helix 26 is connected to earth.

Contact spring 28 is connected to the secondary winding of output transformer 58 of a small speech amplifier contained in the recorder. Apart from the connections to the cathode of V1, this will be recognised by those skilled in the art as a conventional resistance-coupled two-stage amplifier having valves V1 and V2, the input being applied to terminals 59 and 60 and a desired proportion tapped off through volume control 61. Lead 62 from the secondary of output transformer 58 is connected through capacitor 63 to the cathode of V1. V1 also has bias resistor 64 which is not de-coupled. When the contacts of 28 and 29 close, lead 65 from the secondary of transformer 58 is connected to earth so that the voltage in the secondary of transformer 58 is applied to cathode resistor 64 via capacitor 63. If leads 62 and 65 are connected in the correct sense then the heavy positive feedback which results causes the amplifier to burst into violent oscillation and loud speaker 66 emits a loud noise. Furthermore, the noise cannot be stopped by turning volume control 61 to zero.

The operation of the arrangement is as follows:

Assuming that the recorder is ready to operate, then the electrosensitive paper is in position, as shown in Figure 2, and the contacts are in the position shown in that figure. The electric supplies to the signal source and the speech amplifier are switched on, the recording mechanism is stationary and dummy load 57 is connected between lead 56 and earth. Operation of switch 40 energizes clutch 37 which starts the recording mechanism and switches lead 56 to recording electrode 27. The recorder will then operate normally.

If paper supply 20 fails then pressure pad 32 is enabled to move into cavity 34 whereby the contact between 29 and 30 is broken and the contact between 28 and 29 is

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made. In consequence, clutch 37 is de-energized, helix assembly 25 stops and the connection of lead 56 is transferred from recording electrode 27 to dummy load 57. At the same time, the output of the amplifier is applied to its input circuit so that the amplifier bursts into oscillation and loudspeaker 66 calls attention to the failure of the paper.

If the door of the recorder is opened then the pressure of both pressure pads is relieved and they move into the position shown in Figure 4, so that clutch 37 is de-energized to stop rotation of the helix and the output signal from source 55 is transferred to dummy load 57. Since contact between springs 28 and 29 is not made, however, the connection between the amplifier output and input is not made so that loudspeaker 66 remains silent.

I claim:

1. Protective apparatus comprising a member containing a cavity, a first contact spring, a pressure pad attached to the first contact spring, a second contact spring, a second pressure pad attached to the second contact spring, a third contact spring, means to support the contact springs in a position adjacent to said member with the pressure pad of the first contact spring opposite to and urged to enter the cavity in the member and the second pressure pad adapted to press upon a solid portion of the member, the contact springs being set so that when both pressure pads are under pressure contact is made between the first and third but not between the first and second contact springs and when the first pressure pad is free and the second pressure pad is under pressure contact is made between the first and second but not between the first and third contact springs.

2. Protective apparatus as claimed in claim 1 comprising an alarm circuit, the contact springs being connected so that making the contact between the first and second contact springs energizes the alarm circuit.

3. Protective apparatus as claimed in claim 2 comprising a speech amplifier and loudspeaker, the first and second contact springs being connected between the output and input circuits of the amplifier whereby making the contact causes the amplifier to burst into oscillation.

4. Protective apparatus as claimed in claim 2 comprising a magnetic clutch controlled by the contact between the first and third contact springs.

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5. Protective apparatus comprising a member containing a cavity, a first contact spring, a pressure pad attached to the first contact spring, a second contact spring, a second pressure pad attached to the second contact spring, a third contact spring, means to support the contact springs in a position adjacent to said member, with the pressure pad of the first contact spring opposite to and urged to enter the cavity in the member and the second pressure pad adapted to press upon a solid portion of the member, a distance piece to maintain a fixed separation between the second and third contact springs, the contact springs being set so that when both pressure pads are under pressure or neither is under pressure contact is made between the first and third but not between the first and second contact springs and when the first pressure pad is free and the second pressure pad is under pressure contact is made between the first and second but not between the first and third contact springs.

6. Protective apparatus comprising a member having a cavity, a first contact spring, a pressure pad attached to the first contact spring, a second contact spring, a second pressure pad attached to the second contact spring, a third contact spring, means to support the contact springs in a position adjacent to said member, with the pressure pad of the first contact spring opposite to and urged to enter the cavity in the member and the second pressure pad adapted to press upon a solid portion of the member, the contact springs being set so that when both pressure pads are free no contact is made between the first, second and third contact springs and when both pressure pads are under pressure contact is made between the first and third but not between the first and second contact springs and when the first pressure pad is free and the second pressure pad is under pressure contact is made between the first and second but not between the first and third contact springs.

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